

# ZOOTAXA

1025

**Phylogeny and classification of Callimorphini  
(Lepidoptera: Arctiidae: Arctiinae)**

M. A. DACOSTA & S.J. WELLER



Magnolia Press  
Auckland, New Zealand

M. A. DACOSTA & S.J. WELLER

**Phylogeny and classification of Callimorphini (Lepidoptera: Arctiidae: Arctiinae)**

(*Zootaxa* 1025)

94 pp.; 30 cm.

29 July 2005

ISBN 1-877407-14-3 (paperback)

ISBN 1-877407-15-1 (Online edition)

FIRST PUBLISHED IN 2005 BY

Magnolia Press

P.O. Box 41383

Auckland 1030

New Zealand

e-mail: [zootaxa@mapress.com](mailto:zootaxa@mapress.com)

<http://www.mapress.com/zootaxa/>

© 2005 Magnolia Press

All rights reserved.

No part of this publication may be reproduced, stored, transmitted or disseminated, in any form, or by any means, without prior written permission from the publisher, to whom all requests to reproduce copyright material should be directed in writing.

This authorization does not extend to any other kind of copying, by any means, in any form, and for any purpose other than private research use.

ISSN 1175-5326 (Print edition)

ISSN 1175-5334 (Online edition)

## Phylogeny and classification of Callimorphini (Lepidoptera: Arctiidae: Arctiinae)

M. A. DACOSTA<sup>1,2</sup> & S.J. WELLER<sup>1,2</sup>

<sup>1</sup>*Dept. of Entomology, 1980 Folwell Ave, University of Minnesota, St. Paul, Minnesota 55108, USA;*

<sup>2</sup>*Bell Museum of Natural History, 1970 Upper Buford Circle, University of Minnesota, St. Paul, Minnesota 55108, USA*

### TABLE OF CONTENTS

ABSTRACT .....	4
INTRODUCTION .....	4
Taxonomic History of Callimorphini .....	6
Treatments of Palearctic fauna .....	7
Treatments of African, Asian, and Indo–Australian Faunas .....	10
New World comprehensive treatments .....	15
Modern Studies of Arctiidae .....	18
Summary of taxonomic treatments .....	19
MATERIALS AND METHODS .....	19
Specimen preparation .....	19
Collections consulted .....	20
Taxon sampling .....	20
Phylogenetic analyses .....	26
MORPHOLOGICAL CHARACTERS AND OBSERVATIONS .....	27
Characters Examined .....	28
RESULTS AND DISCUSSION .....	59
Phylogenetic analysis .....	59
Character and Outgroup Taxon Jackknifing .....	62
Summary of Phylogenetic and Taxonomic Implications .....	67
Conclusions .....	69
GENERIC CHECK LIST OF CALLIMORPHINI .....	69
GENERIC CHECK LIST OF OLD WORLD PERICOPINI .....	75
ACKNOWLEDGMENTS .....	77
REFERENCES .....	78
APPENDIX 1. QUICK REFERENCE TABLE OF CHARACTERS AND STATES .....	87

## ABSTRACT

A preliminary phylogeny for the Callimorphini and related tribes was constructed based on adult morphology. The data matrix, consisting of 91 taxa and 116 characters (299 states), was analyzed using maximum parsimony. To test the monophyly of the Callimorphini *s.s.* and determine the placement of the *Euchaetes* group, 49 ingroup species and 42 outgroup species were included. Callimorphini was represented by 23 species (11 genera), and the *Euchaetes* group was represented by 26 species (6 genera). Outgroup taxa include both root genera from the Arctiini (10 genera, 12 species) and representative genera from related tribes as “internal outgroups.” Internal outgroups included representatives from Phaegopterini (6 genera, 9 species), Nyctemerini (1 genus, 9 species), and Pericopini (7 genera, 12 species). The data matrix included both nongenitalic and genitalic characters as follows: 7 head (17 states), 5 leg (10 states), 22 wing (57 states), 12 thoracic (29 states), 39 male abdominal and genitalic characters (95 states) and 31 female abdominal and genitalia (91 states). Of these, 36 were multistate and were treated as unordered. Heuristic searches with 20, 100, and 1000 random–taxon additions were performed to sample multiple tree islands.

This study also assessed the utility of adult genitalic character systems for confident resolution of older divergences. The resulting cladistic analysis demonstrated that phylogenetic relationships among closely related genera were recovered; however, genitalic characters do not fully replace information from immature stages. Relationships among major clades remained poorly supported as determined by taxon and character jackknives. Based on these results, a revised concept for Callimorphini is proposed based on well-supported relationships. A checklist of callimorphine genera also is provided. The Old World genus *Nyctemera* is placed in the Pericopini **rev. placement** and *Euchaetes* and allied genera are placed in the Phaegopterini **rev. placement**.

**KEY WORDS:** Arctiidae, Callimorphini, phylogeny

## INTRODUCTION

Callimorphini (Lepidoptera: Arctiidae: Arctiinae), like many tiger moths, are cosmopolitan in distribution and most diverse in the tropics. Adults frequently are brightly colored with orange, pink, yellow, and red scales on the wings and abdomen (Ferguson 1985, Holloway *et al.* 2001). Some members of the Callimorphini, a small tribe of approximately 108 species, resemble butterflies in that they are diurnal (e.g., *Utetheisa* Hübner) or have large wings and “slender” bodies characteristic of butterflies (e.g., *Haploa* Hübner, *Callimorpha* Latreille) (Figs. 1, 2).

Callimorphini, and tiger moths more generally, have captured the attention of scientists because of their coloration and their intriguing biology. In general, arctiid larvae and adults defend themselves from predators with biogenic amines, often in combination with host–plant derived chemicals such as pyrrolizidine alkaloids (PAs), cardiac glycosides (CGs), or sesquiterpenes (reviews: Weller *et al.* 1999; Conner & Weller 2004). These compounds can be found in all life stages in several species. Callimorphini is pivotal for understanding the evolutionary transitions among the different defense strategies within the subfamily Arctiinae (Fig. 3; Weller *et al.* 1999). Most callimorphines use pyrrolizidine